METHODS AND APPARATUS FOR CONNECTING TUBULARS USING A TOP DRIVE

This invention relates to methods and apparatus for facilitating the connection of tubulars using a top drive and is more particularly, but not exclusively for facilitating the connection of a section or stand of casing to a string of casing.

In the construction of wells such as oil or gas wells, it is usually necessary to line predrilled holes with a string of tubulars known as casing. Because of the size of the casing required, sections or stands of say two sections of casing are connected to each other as they are lowered into the well from a platform. The first section or stand of casing is lowered into the well and is usually restrained from falling into the well by a spider located in the platform's floor. Subsequent sections or stands of casing are moved from a rack to the well centre above the spider. The threaded pin of the section or stand of casing to be connected is located over the threaded box of the casing in the well to form a string of casing. The connection is made-up by rotation therebetween.

It is common practice to use a power tong to torque the connection up to a predetermined torque in order to perfect the connection. The power tong is located on the platform, either on rails, or hung from a derrick on a chain. However, it has recently been proposed to use a top drive for making such connection either alone or in combination with a power tong.

It has been observed that sections or stands of tubulars are often not as uniform as desired. In particular, the sections or stands of tubulars are often not straight. The top drive is in perfect alignment with the centre of the spider in the platform of an oil or

gas rig. However, a section or stand of tubulars located in the spider would not always be in alignment with the top drive.

According to a first aspect of the present invention there is provided an apparatus for facilitating the connection of tubulars using a top drive, the apparatus comprising a stator attachable to said top drive, and a supporting member for supporting a tool wherein means are provided to allow substantially horizontal movement of said supporting member.

According to a second aspect of the present invention there is provided a method for facilitating the connection of tubulars using a top drive, the method comprising the steps of attaching a tool to the top drive using a supporting member and adjusting the supporting member to cause the tool to be displaced horizontally relative to the top drive.

For a better understanding of the present invention and in order to show how the same may be carried into effect reference will now be made, by way of example, to the accompanying drawings, in which:

Figure 1 is a side view in perspective of an apparatus in accordance with an embodiment of the invention in use;

Figure 2 is an enlarged view of parts of Figure 1, with parts inserted in a tubular and with parts cut away;

Figure 3 is an enlarged cross-sectional view in perspective of part of the apparatus of Figure 1;

Figure 4 is an enlarged view of parts of the supports of Figure 1 in a displaced position;

Figure 5 is an enlarged view of parts of the apparatus of Figure 1 in a second displaced position;

Figure 6 shows the apparatus of Figure 1 in a further stage of operation; and

Figure 7 shows a second embodiment of the present invention.

Referring to Figure 1 there is shown an apparatus which is generally identified by reference numeral 1.

The apparatus 1 depends from a rotor 2' of a top drive 3. A tool 4 for gripping a tubular depends from the lower end of the apparatus 1. A rigid guide member 5 is provided to guide the rotor 2 of the apparatus 1. The rigid guide member 5 is fast with a stator 5' of the top drive 3. The rotor 2' of the top drive 3 is coupled by a threaded connection to the rotor 2 of the apparatus 1. The rigid guide member 5 may be provided with a clamp for clamping the rotor 2 of the apparatus 1 so that the threaded connection to the rotor 2' of the top drive 3 can be made, after which the clamp would be released.

An elevator 6 is provided on the end of bails 7, 8 which are hung from the top drive 3. Piston and cylinders 9, 10 are arranged between the bails 7, 8 and the top drive 3 for moving the elevator 6 from below the top drive 3 to an out of the way position.

Referring now to Figure 2, there is shown the apparatus 1 which comprises a plate 11 which is fixed to a connecting tubular 12 by a collar 13. The connecting tubular 12 passes through a hole 14 in rigid body 5 and connects with the rotor 2 (Figure 1). The plate 11 has two projections 15 and 16 which have holes 17 for accommodating axles 18 which are rotationally disposed therein. The axles 18 are integral with a rigid body 19. A slider 20 is arranged on runners 21 on either side of the rigid body 19. Arms 22 are connected at one end to the slider 20 via spherical bearings 23.

The other end of arms 22 are connected to a supporting member 24 via spherical bearings 25.

The arms 22 and are provided with lugs 26 to which one end of a piston and cylinder 28 and 29 is attached and are movable thereabout. The other end of each piston and cylinder 28 and 29 is attached to lugs 30 and 31 and is movable thereabout. The lugs 30 and 31 are fixed to plate 11.

A mud pipe 32 is provided between the plate 11 and the supporting member 24 for carrying mud to the inside of a tubular therebelow. The mud pipe 32 is located in cylindrical sections 33 and 34 which are attached to the plate 11 and the supporting member 24. The mud pipe 32 is provided with a lobe 35 formed on the outer surface thereof and is located in a corresponding recess 36 in a cylindrical section 33 (Figure 3). A lobe 37 is slidably arranged on the lower end of the mud pipe 32 with an o-ring seal 38 arranged therebetween to inhibit fluid from leaking therebetween. The lobe 37 is located in a corresponding recess 39 in cylindrical section 34. This arrangement allows a ball and socket type movement between the plate 11 and the supporting member 24 and relative longitudinal movement therebetween.

Referring back to Figure 2, a tool 4 for gripping a tubular is fixed and depends from the supporting member 24 of the apparatus 1. Such a tool may be arranged to be inserted into the upper end of the tubular, with gripping elements of the tool being radially displaceable for engagement with the inner wall of the tubular so as to secure the tubular to the tool.

In use, a tubular 40 to be connected to a tubular string held in a spider (not shown), is located over the tool 4. The tool 4 grips the tubular 40. The apparatus 1 and the tubular 40 are lowered by moving the top drive so that the tubular 40 is in close

proximity with the tubular string held in the spider. However, due to, amongst other things, manufacturing tolerances in the tubular 40, the tubular often does not align perfectly with the tubular held in the spider. The apparatus 1 allows minor vertical and horizontal movements to be made. The piston and cylinders 28 and 29 allow vertical movement, and may be controlled remotely. The piston and cylinders 28 and 29 may be of the pneumatic compensating type, i.e. their internal pressure may be adjusted to compensate for the weight of the tubular 40 so that movement of the tubular may be conducted with minimal force. Pneumatic compensating piston and cylinders also reduce the risk of damage to the threads of the tubulars. This can conveniently be achieved by introducing pneumatic fluid into the piston and cylinders 28 and 29 and adjusting the pressure therein. The piston and cylinders 28 and 29 may be hydraulic or may be hydraulic and provided with pneumatic bellows.

Tubular manipulating equipment such as stabbing guides may be used to direct the pin (not shown) of the tubular 40 into the box of the tubular string held in the spider. The apparatus 1 allows horizontal movement of the tubular 40 relative to the top drive 3. Once the tubular 40 is in line with the tubular string, the top of the tubular 40 may be brought in line with the top drive which may be carried out with pipe handling equipment. The top drive 3 is now in direct alignment with the tubular string held in the spider, and can now rotate the apparatus 1 and hence the tool 4 and the tubular 40 to perfect a connection between the tubular 39 and the tubular string.

Figure 4 shows the supporting member 24, the tool 4 and the tubular 40 laterally in a `Y` direction out of alignment with the top drive 3. The mud pipe 32 has moved in recesses 36 and 39 and longitudinally in relation to o-ring seals 38. The piston and

cylinders 28 and 29 have moved about lugs 26, 27, 30 and 31. Arms 22 and 22' have moved about spherical bearings 23, 23', 25 and 25'.

Figure 5 shows the supporting member 24, the tool 4 and the tubular member 40 laterally in an `x` direction. The mud pipe 32 has moved in recesses 36 and 39 and longitudinally in relation to o-ring seals 38. The piston and cylinders 28 and 29 have moved about lugs 26, 27, 30 and 31. Rigid member 19 has moved about axles 18 and 18' and spherical bearings 23.

Figure 6 shows the elevator 6 swung in line with the top drive 3 by rotation of the piston and cylinders 9 and 10 acting on bails 7 and 8. The elevator 3 is located below a box 41 of tubular 40. The tubular 40 may be released from engagement with the tool 4. The elevator 6 may now be raised to take the weight of the tubular 40 and tubular string. The tubular string may now be lowered into the well.

Figure 7 is a second embodiment of the present invention and is generally similar to that of Figures 1 to 6 further incorporating adjusting piston and cylinders 42 and 43 so that actuation of the piston and cylinders 42 and 43 can move the supporting member 24, the tool 4 and the tubular 40 depending therebelow in a horizontal plane in an x and y axis.

The piston and cylinder 42 is arranged between the plate 11 and the rigid member 19 on lugs 44 and 45. Actuation of the piston and cylinder 42 moves the supporting member 24, the tool 4 and the tubular 40 along a generally x-axis about axles 18 and 18'.

The piston and cylinder 43 is arranged between an extension of arm 22 and slider 20 on lugs 46 and 47. Actuation of the piston and cylinder 43 moves the supporting member 24, the tool 4 and the tubular 40 along a generally y-axis about

spherical bearings 23, and 25 and the corresponding spherical bearings arranged in arm 22'.

The piston and cylinders 42 and 43 may be hydraulically of pneumatically operable and may be controlled via a remote control unit (not shown).

In use, a tubular 40 may be gripped by the tool 4 in the way described above and lowered into close proximity with the tubular string held in a spider. The adjusting piston and cylinders 42 and 43 may then be actuated to obtain alignment of the pin of the tubular 40 with the box of the tubular string held in the spider. The tubular 40 may then be rotated to obtain a partial connection or be held in alignment with an additional tool. The piston and cylinders 42 and 43 may then be returned to their original positions to obtain alignment with the top drive 3. The top drive 3 may then be used to torque the connection up to a predetermined torque to complete the connection.

It is envisaged that various modifications may be made to the above described embodiments, such as using a hydraulic motor in place of the supporting member 24.